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PROCESS FOR PRODUCTION OF X-RAY INTENSIFYING FILMS

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PROCESS FOR PRODUCTION OF X-RAY INTENSIFYING FILMS

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ABSTRACT. The casting of a high concentration of intensifier in a low percentage of gelling agent(s) is controlled to form a uniform deposit. The process is automated readily and requires little or no highly-volatile solvent.

The invention concerns a process, that makes possible the manufacture of X-ray intensifying films in aqueous solution of gelatine or other water--soluble gelatinizing agents. /1*

The known procedures for making X-ray intensifier films according to the coating process predominantly used as binding agent for the intensifier, cellulose esters or cellulose compounds or plastics in organic solvents. The processing in organic solvents, according to their hazards to health presuppose precautions, which (hazards) have to be eliminated by a more or less great hindrance to working. This includes the use of protective masks, which makes working difficult, the vision partially limited by reflection and body movement restricted by their use. The whole installation of apparatus and the accessories must be protected against explosion, and the production spaces must comply with structural and local specifications. The costly solvents get carried off by evaporation and thus no longer are recoverable.

A known way of casting X-ray intensifier films is spinning out an X-ray luminescing substance in an organic or inorganic solvent and distributing the suspension obtained on a level glass plate by rapid pouring out. That requires a frame around the glass plate, so the liquid cannot flow over the edges, and a large amount of liquid, so that the suspension can be distributed as quickly as possible over the whole glass face. Irregularities in the subsequent sedimentation of the intensifier from the suspension cannot be

*Numbers in the margin indicate pagination in the foreign text.

avoided there, so that the proportion of intensifier to particular surface units of the cast area cannot be uniform.

The process of making intensifier films by electrophoresis avoids the inequalities within certain limits, but requires special carrier material with conducting substances. Also known is production of intensifier films by the drum process. With this method indeed it is emphasized that a uniform luminous layer is obtained, however, no maintenance of signal sharpness is considered. The high proportion of binding agent between the intensifier crystals causes a decrease in sharpness.

By a combination of plastic with the advantages of gelatine it was sought, by addition of so much gelatine to an aqueous dispersion of plastic, to attain gelatinization of the poured layer. Even with this process according to the known methods with a greater amount of liquid the suspension is distributed over a limited area.

The function of the invention, through a high concentration of intensifier in a low percentage gelatine solution, is to keep the intensifier in suspension by the flow rate, to utilize the apparent viscosity for castability, and after /2
cessation of flow to reach a fast sedimentation of the intensifier. The gelatine can be partly substituted by other gelling agents such as tragacanth, agar-agar, albumins, etc.

It was found, that by the effect of concentration of the intensifier, which is suspended in a thin, aqueous 2-3% gelatine solution, with this mixture at high flow rate through a casting device with slits a continuous and uniform liquid curtain is attained, which the cast width on the casting support does not modify, but surface tension holds the moist surface together and it does not run apart as cast areas. The total intensifier sediments very rapidly. The necessary transportability is attained by cooling down to -10°C, when the gelatine solution solidifies, without the texture of the sedimented intensifier being changed.

The signal sharpness and with it the definition of an X-ray picture depends on the ratio of intensifier to binder in the luminous layer. By a high concentration of intensifier in the casting suspension and a small proportion of binding agent in it, the requirement is satisfied.

It is acknowledged that a percentage ratio of binder to intensifier should not exceed 22%. The suspension used according to the invention has a ratio of 4-7% and so presents a qualitative improvement. The low content of gelatine as binder for the luminous film also allows appearance of the action of remission through the carrier material, which may consist of paper-board, plastic or plastic-coated paper-board. With that an optimum in luminous matter density, luminous matter packing density, and binding agent is reached with respect to luminous intensity and signal sharpness.

The invention offers the advantage of a uniform distribution of the luminous substance as a result of the uniform coating of a suspension curtain and rapid sedimentation upon interruption of the flowrate, which underlies the suspension until removal of the casting slit. From the uniform coating thickness there results likewise uniform luminous density within each individual intensifier film and from one film to another. Through the growth of automatization of the X-ray photographic technology by automatic exposure, which fixes the roentgen dose for the exposure on the basis of the absorption, a uniform quality in exposure density is attributed great value, and thus it has become necessary to have at hand X-ray intensifier films that have a narrow production deviation. While with casts over an area to receive a somewhat uniform layer a completely horizontally set casting support is required, with the process according to the invention a slight deviation from the horizontal position can be present, because the surface tension prevents sliding off.

By the ratio of binder to luminous material of 4-7% a compact, but not brittle layer of luminous material is produced, that owing the the high packing density provides a high signal sharpness. The essentially smaller amounts of water that the raising of a curtain of aqueous suspension on a plane support requires, as against the distributive pouring over a plane area, call for a shorter drying time of the suspension of luminous substance. Added to this is the advantage of saving in energy for drying. Notoriously the striving to automatixe all processes goes apace today. The process according to the invention needs no framing of the casting support, which can consist of glass, plastic or metal, and so makes possible connection to machinery units, which permits an automatization of the whole manufacture of X-ray intensifier films, with use of water as solvent, because the decisive casting process through slits, the subsequent sedimentation and cooling make possible a continous and repetitive running. So (too) putting on a protective layer of plastic or the like can occur dustproof with a lacquer/varnish casting machine onto a glass support. In contrast to the later application of a protective skin on the luminous layer by dipping or spraying, a uniform, very thin protective skin may be produced before the casting of the layer of luminous substance and contains in itself the advantage of optical equality over the entire surface of X-ray intensifier film.

Example 1:

100 g of gelatine and 50 g of agar-agar are dissolved in 10 liters of water, 10 g of glycerin is added and then with stirring 3.5 kg of luminous substance. The stirring rate is adjusted to keep the luminous matter suspended. The suspension is held at 35°C themostatically and a casting gap 1 mm wide is supplied, with a filled height of 6 cm. Under the casting slit a plane, 55 × 75 cm plate glass pane is advanced by a conveyor belt at a rate of 13.5 m/min. The plate coated with suspension is belt-conveyed farther for 3 minutes at 1 m/min., so that the luminous material has time enough to sediment and form a dense luminous layer. Next the plate goes at the same rate through a cooling channel 2 m long, in which a -10°C temperature prevails. After leaving the cooler the solution has congealed and is transportable.

Example 2:

This example shows changing the ratios gelatin-luminous material-coating rate for a stronger coated film, by which in use a higher luminous intensity is claimed. 300 g gelatine is dissolved in 10 l water, 30 g glycerin is added and then with stirring 6.6 kg of luminous material. The stirring rate is regulated to maintain suspension of the intensifier. Temperature of the suspension is kept at 35°C thermostatically and a casting slit 1 mm wide is supplied with a 6 cm filled height. Under the slit a plane plate glass pane is moved by belt conveyor at 10.8 m/min. The 55 × 75 cm glass plate covered with suspension of luminous material is belt-conveyed on for 3 min at 1 m/min to allow time for sedimentation and formation of a dense layer of luminous substance. At the same rate the coated plate passes through the 2 m, -10°C cooler. After leaving the cooling channel the suspension, whose luminous material occurs as sedimentation layer, solidifies and thence is transportable. The total automated course of the production is fashioned as follows: the plate glass, plastic or metal plates, serving as casting supports are sent to a surface-cleansing machine and then through a dryer. From there they are led by belt conveyor through a lacquering machine, which yields a thin lacquer coat of 14 mg lacquer/cm^2. Within 5 min this lacquer is dry and reaches the casting slit, where it is coated with the suspension of luminous material. The supplying and preparation of the casting suspension is done in an automatic measuring machine. After the associated sedimentation and cooling the plate goes through a drying tunnel, in which the excess water is removed. The dry luminous film is covered with a carton that absorbs practically no X-radiation, and the now finished X-ray intensifying film is stripped from its support. The total tempo of the automatic assembly is so regulated, that every minute a finsished, 55 × 75 cm X-ray intensifier film can be drawn off its support. /3

Patent Claims:

1. Process for manufacturing X-ray intensifier films, characterized in that a suspension of luminous material of high intensifier concentration in a 2-3% gelatin solution is poured through a casting slit onto a rapidly moving plane surface of glass, plastic or metal and the distributed suspension is held together by the surface tension.

2. Process according to Claim 1, characterized in that within a suspension made coherent by surface tension a complete and uniform sedimentation of the luminous matter contained in the suspension occurs over the whole moistened area.

3. Process according to Claims 1 and 2, so characterized, that the sedimented luminous layer with the gelatin solution is brought to gelatinization by cooling down to -10°C without alteration of the luminous stratum.

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